Optimization of process parameter of Hybrid Water Pumping System used in irrigation

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ABSTRACT

In India today, the use of solar pumping system is an effective and economical method to pump water from well into the irrigation system. But in some places where we can't generate that much electricity with the aid of solar power that can raise the water out of the well and can be used for irrigation. Hybrid water pumping system(HWPS) is required . It consist of mainly solar and wind turbine which can be used to charge the battery and these energy can be used to lift water from well. The comparative study has been done that how much time is required for charging the battery in normal condition with three conditions i.e with solar panel, with wind turbine and with solar panel and wind turbine both.

Keywords:- solar panel, wind turbine and battery

1. INTRODUCTION:

In India, diesel power pumping system is widely used for irrigation purpose. But in the country's inner parts where energy is scarce. In these regions mainly in interior parts of India, where electric supply is only for few hours in a day. The investigation for secondary source of energy has been there to fulfil the requirement of water for irrigation. In these parts mainly in Vidharbha parts of Maharashtra (India) region the electricity cost is maximum and these cost is not affordable by most of the farmers which may lead to maximum suicide cases in these parts of the region. Additionally, in some barely occupied regions where standard water system for watering feels is urgent, frequently meagre power infrastructure creates customary water system convoluted, essentially driving operational and support costs. Countering such entanglements and challenges, hybrid water pumping system (HWPS) are the ideal answer for both balance infrastructural constraints and decrease maintenance / support costs.

2. HYBRID WATER PUMPING SYSTEM (HWPS)

The hybrid water pumping system uses solar panel and wind turbine which will be used to charge battery for pumping system. The main parts of hybrid water pumping system are:

1. Solar panel, 2. Wind turbine, 3. Rectifier, 4.Booster pump, 5. Battery, 6. Charge Controller,

7. UV water purifier ,8. Flow control Valve

2.1 Solar Panel

Fig 1. Solar Panel used for hybrid pump

Photovoltaic modules use photovoltaic impact light source from Sun for power generation. Most modules use crystalline silicon cells based on heat. Solar plate ought to be shielded from mechanical harm and dampness. Connections are arranged in series for accomplishment of wanted yield voltage.

2.1.1 Specifications:

Rated maximum power: 5 watt, Open circuit voltage: 21 volt,

Short circuit current: 0.6 amp Rated voltage: 16 volt,

Rated current: 0.33 amps

2.2 Wind Turbine:

The device that concentrates vitality from the breeze is known as a wind turbine. The vitality picked up from the breeze is utilized for machining purposes for example, cutting wood or crushing stones, a machine is known as windmill, and additionally it is utilized for siphoning water called as wind pump. Wind turbines separated in two sorts as Horizontal axis and Vertical axis wind turbine

2.2.1 Specifications:

Dimension of vanes: 110 mm * 80 mm (l*b), current produced: 1 Ah

2.4. Battery :-

Almost all vehicle, bike and tractor battery are 12-volt, lead-acid battery. This battery can give many amps of electrical flow for a brief timeframe. Not each of the 12-volt, lead-acid battery are compatible, in any case. It is critical to consider the car's electrical necessities before endeavoring to introduce 12-volt battery.

2.5 Charge Controller :

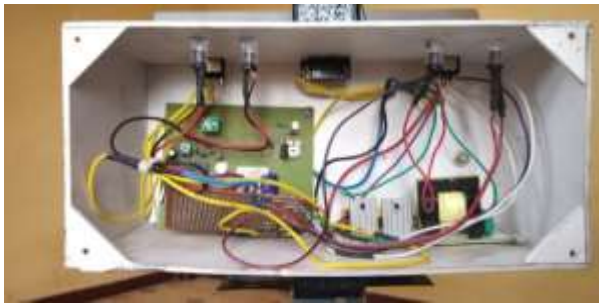

Fig.5. Charge Controller

A charge controller restrains the rate of addition and widrawal of electric current from battery. It counteracts overcharging and may ensure against overvoltage, which can decrease the life of battery.

2.6 UV Water Purifier:

Fig.6.UV Purifier

UV Systems are the demonstrated method to protect family's drinking water. At the point when you introduce UV water filtration, you are safe and can drink with certainty. You never again must be worried about terrible water tests, bubble water warnings or defilement by hurtful smaller scale creatures. The PWS UV range utilizes the equivalent demonstrated UV innovation utilized by huge systems that decontaminate the main brands of filtered water and the drinking water of significant US and European urban areas.

2.7 Stream Control Valve :

Fig. 7. Flow Control Valves

The stream control valve directs the stream / pressure of the liquid. Stream control valves typically reacts the signals produced by autonomous devices for example, stream meters or temperature measures. Stream control valves are ordinarily fitted with actuators and applicants.

3. WORKING AND DESIGN OF HYBRID WATER PUMP SYSTEM

Hybrid Energy water pumping system (HWPS) incorporate at least two types of vitality sources. Water pumping structured dependent on one type of sustainable power source assets have the downside of being larger than usual because of the absence of accessibility. The solar–wind hybrid form schematically outlined i in Fig.8

3.1 Design and Calculations

3.1.1 Condition (i):- Both the source (wind & solar) are charging battery at a time:-

Solar panel specifications:

Rated maximum power: 5W; Current produced: 0.6Ah

Wind turbine specifications:

Current produced: 1.0Ah

Calculation of Current and Time required for battery charging

Here is the formula of Charging Time of a Lead acid battery.

Time to charge, T = 8Ah /1.6A For 8 Ah battery,

As charging current should be 10% of the Ah rating of battery.

So, charging current for 8Ah = 8 x (10/100) = 0.8 Amp.

Considering various losses,

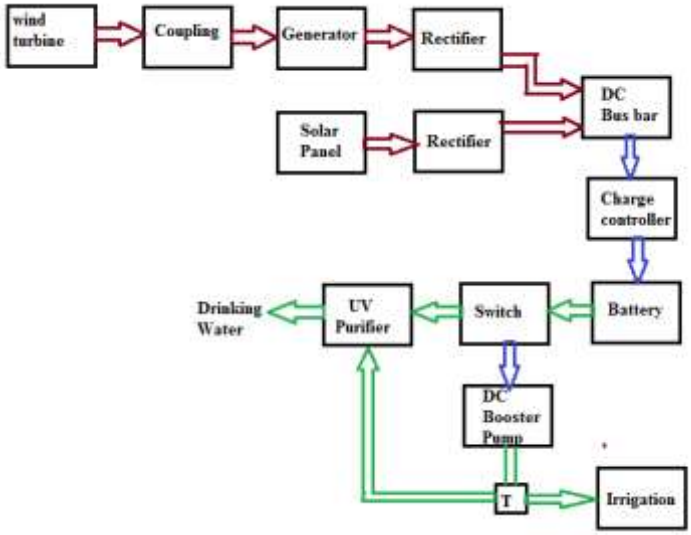

Fig. 8. Block diagram of HEWPS

Charging time for 8Ah = 8 / 1.6 = 5Hrs. or 300 minutes

but this was an ideal case… practically, this is noted that 10% of losses (in case of battery charging)

then 8 x (10 / 100) = 0.8 hr…..(8Ah x 10% of losses)

therefore, 8 + 0.8= 8.8 Ah (8 Ah + Losses)

Now Charging Time of battery = Ah/Charging Current

8.8 / 1.6 = 5.9 Hrs or 354 minutes (in real case)

Therefore, an **8Ah** battery would take **5.9 Hrs or 354 minutes.**

3.1.1 Condition (ii)-when only solar energy is available:-

3.2 Condition

When only wind energy is available :-

Time to charge the battery, T = 8Ah /1A

For 8 Ah battery,

Charging time = 8 / 1.1 = 7.3Hrs or 438 minutes. (Ideal case)

then 8 x (10 / 100) = 0.8 hr…..(8Ah x 10% of losses) therefore, 8 + 0.8 = 8.8 Ah (8 Ah + Losses) (Cosidering 40% losses)

Now Charging Time of battery = **8.8 / 1 = 8.8 Hrs or 528 minutes (in real case)**

Therefore, an **8Ah** battery would take 8.8 Hrs or 528 minutes for completely charging (with 1A charging current).

3.4 Results

The average Charging Time for battery from January to March 2018 which is given below has been recorded:-

Table 1. Time required for Battery Charging

Parameter	Time required in Hours								
	Solar panel and Wind turbine			Only Solar Panel			Only Wind Turbine		
	Jan	Feb	Mar	Jan	Feb	Mar	Jan	Feb	Mar
Ideal case	4.8	4.9	5	8.7	8.8	8.9	7.1	7.2	7.3
Actual case	5.7	5.8	5.9	14.5	14.6	14.7	8.6	8.7	8.8

4. CONCLUSIONS

1. There is not much difference in time to charge the battery when the pumping system is used for wind turbine and solar and wind turbine both.

2. There is a large difference in charging of battery when pumping system is only used with solar panel.

3. Water is pumped from deeper places such as well.

4. Hybrid water pumping system can be efficiently used for irrigation purpose.

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